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GAINS IN USSR LEPTOSPIROSIS STUDIES IN THE 50 YEARS OF SOVIET RULE

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by

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GAINS IN USSR LEPTOSPIROSIS STUDIES IN THE 50 YEARS OF SOVIET RULE

V. S. Kiktenko*

The Great October Socialist Revolution opened a new era in man's history and laid down highly promising conditions for a new advanced society. It is not remarkable therefore that our homeland has in a short time been transformed from an economically backward to a highly developed nation of advanced science and technology. Large advances have been made in years past in the country's public health. An attempt is made in this survey to briefly highlight the results of leptospirosis studies in the USSR.

Leptospirosis began to be studied systematically in the Soviet Union only by 1928, when S. I. Tarasov and G. V. Epshteyn, V. A. Bashenin, V. I. Terskikh and others in Moscow Oblast described a "new" epidemic disease (water fever) that proved to be nonjaundice leptospirosis. An important role in widening scientific research and in training cadres needed by the country was played by leptospirosis laboratories set up to study this infection (in the Central Institute of Epidemiology and Microbiology and in the Moscow Institute of Vaccines and Sera imeni Mechnikov).

At first, prime attention was paid to discovering natural foci of leptospirosis in different parts of the country, studying clinical aspects, epidemiology, and prevention of nonjaundice leptospirosis. Based on these studies, the broad extent of leptospirosal foci in several rural areas, especially in the Northern Caucasus, in the central part of the country, and in the Far East was established. As a result of sweeping studies of natural leptospirosal foci, geographic and terrain confines, infection reservoirs in foci, epizootic dynamics, and so on were also established. The problem of sources of leptospirosal infection in

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natural foci was also clarified (S. I. Tarasov, I. I. Nikolayev, V. V. Anan'in, K. N. Tokarevich, Ye. V. Karaseva, A. A. Varfolomeyeva, etc.). In infection foci, different animals belonging to the orders of Rodentia, Insectia, Carnivora, and Chiroptera are found to be affected with leptospirosis.

Animals of the family of Muridae and Cricetidae, as indicated, play the largest role: root vole (Microtus oeconomus), common vole (Microtus arvalis), field vole (Microtus agrestis), water vole (Arvicola terrestris), brush vole (Microtus majori), narrow-skulled vole (Microtus stenocranius), redbacked vole (Clethrionomys glareolus), striped field-mouse (Apodemus agrarius), common field-mouse (Apodemus silvaticus), house mouse (Mus musculus), harvest mouse (Micromys minutus), common hamster (Cricetus cricetus), great gerbil (Rhombomys opimus), tamarisk gerbil (Meriones lamariscinus), little suslik (Citellus pygmaeus), forest dormouse (Dromys nitedula), etc. Along with rodents, leptospirosal infection in foci is discovered in the common shrew (Sorex araneus), hedgehogs (Erinaceus), European polecat (Putorius putorius), water shrew (Neomys fodiens), Altai mole (Talpa altaica), axis deer (Cervus horbulorum), and so on. Serologically, leptospiral antigens have been found in the wolf (Canis lupus), fox (Vulpes vulpes), Siberian weasel (Kolonocus sibiricus), ermine (Mustela erminea), muskrat (Ondatra zibethica), Ussuri tiger (Felis ussuricus), Ussuri raccoon-dog (Nyctorentes procionoides ussuricus), squirrels, Horsfield's terrapin (Testudo horsfieldi), etc.

Leptospirosal infection of these animal species and consequently their part in maintaining foci are dissimilar. In the view of V. V. Anan'in, voles play the paramount role in forming most of the leptospirosal foci investigated. It has been found that in different foci leptospirosis of a number of serological types and the same kind can affect several rodent species. Etiological structure of natural foci of leptospirosis is determined by numerous factors -- fauna of small mammals, climatic conditions, and so on.

Detailed study of the ecology of these animals in the foci, recording of their population levels, course of the epizootic processes, and avenues of the circulation of causative agents have meant the accumulation of important material characterizing the conditions of existence of natural leptospirosal foci.

Fairly complete information has been assembled also on the epidemiology of outbreaks of water fever encountered in the southern parts of the country and associated with persons swimming in waters used by farm animals.

In the course of investigating leptospirosal foci, Soviet scientists have discovered several serological types and subtypes of leptospira new not just in the Soviet Union, but also unknown abroad. These must be

mentioned: L. grippotyphosa (S. I. Tarasov, 1928), L. tarassovi (S. I. Tarasov et al, 1940), L. kasachstanica I and II (T. A. Krepkogorskaya, 1940, 1951), L. ussuri (N. N. Kraminskaya, 1954), L. muris (N. N. Kraminskaya and V. A. Eskin, 1966), L. pomona mozdok (L. P. Semenova, 1965), etc. Territorial distribution of leptospirosis of these and other serological types across the face of the country was found to differ, but it goes without question that the etiological structure of human diseases corresponds to the etiological structure of local natural foci of leptospirosis. Lively discussion was stirred and is even continuing to be stirred in domestic and foreign literature on the question of the systematics of L. kasachstanica. These leptospiroses, isolated from sick persons, domestic and wild animals in the Kazakh SSR, naturally are viewed as pathogenic. At the same time, careful study of these leptospiroses has shown that in resistance (stability to copper salts), lipasic activity, oxidasic reaction with phenylenediamine, and the absence of pathogenicity for guinea pigs, these serological types stands closely related to saprophytic leptospira (A. A. Varfolomeyeva et al, 1965). Such characteristics of pathogenic strains evidently more properly show inadequacies in prevailing methods of differentiating them from saprophytic leptospira. The opinion put forth by a number of researchers on the possibility of the conversion of saprophytic leptospira into pathogenic and vice versa must be objected to. The position on a well enough defined delimitation of pathogenic microorganisms and saprophytic microorganisms (based on their ecological and biological characteristics), confirmed in domestic microbiology and epidemiology, is also fully extended to leptospira.

Problems of classifying leptospira and leptospirosis have attracted no less attention. Classifications published by several Soviet leptospirologists (V. V. Terskikh, Kiktenko, V. V. Anan'in, A. A. Varfolomeyeva, K. N. Tokarevich, and so on) based on systematics of domestic strains of leptospira doubtless have proven useful in conducting practical studies on leptospirosis. Recently, however, the need has arisen to lay down, in addition to national, standardized international classifications of leptospira, which is being done with participation of Soviet representatives. The main difficulties coming up in systematizing are related to a lack of knowledge on the nature of leptospira, which does not allow a scientifically valid determination of the species of this order of spirocheta. The volume of research done in this area (A. S. Samedov, Yu. G. Chernukha, G. I. Stepanchenok-Rudnyak, Z. Kh. Karimova, S. V. Rostomyan, etc.) is clearly inadequate.

A great effort has been put forth in studying mechanisms of the transmission of infection among rodents (and among other animals) in natural foci. The fascinating idea that leptospiroses are among the class of transmissible infections with natural focality has not found confirmation (I. Z. Soloshenko, 1958-1959; M. A. Musayev, 1959, etc.). The hypothesis that chronic forms of leptospirosal infection with long-term and massive leptospirourea exist among rodents has proven to be

better substantiated. It is assumed that infection of wild animals proceeds both orally (upon eating infected flesh) as well as sexually. What method predominates is not known.

It must be pointed out that investigators have contributed greatly to the study of natural foci of leptospirosis. This has been much advanced by the theory of Ye. N. Pavlovskiy on the natural focality of transmissible diseases. Nonetheless, several biological phenomena accounting for the existence of a natural focus have not yet been studied enough. Further research in this area must be conducted systematically over a period of many years and with participation by specialists in neighboring disciplines.

A spur to the broader study of leptospirosis not just in the Soviet Union but also abroad is represented by the research done by Soviet workers aimed at elucidating a special disease of cattle — icterohemoglobinuria. This disease, initially held to be an infection of viral etiology, was further determined to be one of the forms of animal leptospirosis (A. A. Avrorov, V. I. Terskikh, M. V. Zemskov, etc.) that soon found confirmation in other countries (Israel, the United States, Australia). Icterohemoglobinuria has proven to be a widespread infection recorded in different areas of the country and its investigation opened up a new chapter in the field of infectious diseases of animals. A 20-30 percent mortality rate for ailing cattle and even higher, a reduction or cessation of lactation in cows, loss of weight, etc. inflict heavy economic losses. In addition to cattle, appreciable leptospirosal attacks were subsequently determined to take place among hogs (V. I. Terskikh, A. A. Varfolomeyeva, and V. I. Degtyarev), horses (S. Ya. Lyubashenko and L. S. Novikova), sheep (K. M. Safarov), buffalo (M. A. Musayev), dogs (N. I. Amosenkova and Ye. M. Popova, I. K. Chulovskiy, and I. S. Bezdenezhnykh), and other animals. In the Soviet Union, leptospirosis is most widespread among hogs and cattle. Of fur animals raised in captivity, leptospirosis has been established in silver-black foxes, polar foxes, and nutria (S. Ya. Lyubashenko, I. I. Nikolayev, L. S. Novikova, T. A. Krepkogorskaya, etc.). On farms where epizootia break out, usually massive disease among wild animals with high mortality is observed.

Particular interest was raised by studies establishing leptospirosal diseases in birds. It was possible to discover the diseases by serological research (B. V. Vysotskiy, 1949; S. Ya. Lyubashenko, 1951, etc.). In addition, a leptospirosal culture was obtained (F. K. Nasibulina et al, 1965; T. A. Tagi-Zade and F. P. Alekperov, 1967). Numerous serological types of leptospira, as to be expected, correspond to leptospira isolated from man.

Infection of persons by leptospirosal-attacked animals, as in natural foci, occurs mainly in water contaminated with excrementa of ailing farm animals. Due to the very high spread of leptospirosis among domestic animals and the weighty economic loss inflicted on the national economy by this infection, it is necessary in the very near future to pay greater

to this disease class in scientific research as well as in organizing practical measures.

Some Soviet scientists have advanced the view that farm animals can be an independent source of leptospirosal infection existing independently of the natural foci, that is, of rodent leptospirosis (P. F. Khorunzhenko, V. I. Terskikh, Ye. F. Tsiss, B. V. Vysotskiy, A. V. Dezhurova, etc.). This probably is suggested by the fact that leptospirosis-carrier status has been observed for several animal species. From the data of a number of investigators, animals surviving leptospirosis can over a long period (up to year and longer) can remain leptospirosal carriers. Among sheep, carriers amount to 1-2 percent, among cattle — 2-5 percent, among dogs — 20 percent, and among hogs — up to 70 percent (S. Ya. Lyubashenko, 1966). There are also indications that leptospirosis-carrier status also exists among healthy cattle (Ye. N. Gorshanova).

Other researchers assume that only rodents are the main reservoirs of leptospirosal infection in nature. Farm animals becoming infected by them are an additional, secondary reservoir of infection (V. V. Anan'in, A. A. Varfolomeyeva, S. Ya. Lyubashenko, V. S. Gazar'yan, etc.). An answer to this question is fundamental to organizing antiepidemic and anti-epizootic measures for leptospirosis. However, data gathered thus far do not afford an unreserved support for this point of view. Practically speaking, we must deal with the existence of natural leptospirosal foci with leptospirosis-carrying rodents and with anthropourgic foci with leptospirosis carriers — farm and domestic animals.

Major successes have been gained by Soviet researchers in battling leptospirosis and in its elimination. We must mention here first of all the system of detecting the "elementary focus" and its elimination developed by Ye. V. Karaseva, V. V. Anan'in, Ye. V. Narskaya, etc. Successful elimination of rodents in several localities of the Soviet Union that has been based on this method affords grounds to view it as bearing great promise. We must also note experience in treating natural foci of leptospirosis (with the aim of deratization) using poison bait scattered from aircraft.

Valuable research has been done on the study and sanitation of natural leptospirosal foci (K. N. Tokarevich, M. Ya. Lavorva, I. L. Kokovin, I. Z. Soloshenko, Yu. G. Chernukha, A. P. Krasil'nikov, B. V. Vysotskiy, A. V. Dezhurova, V. V. Mefod'yev, Ye. N. Gorshanova, V. I. Seredina, etc.).

The question arises as to whether at the present time we know enough enough to formulate a theory for the elimination of this infection based on epidemiology and epizootology of leptospirosis. Analysis of the results of long years of theoretical and practical work by Soviet scientists on leptospirosis allows us to consider this as timely, though as to anthropurgic foci in particular. During the time elapsing since isolation of leptospirosis in the USSR, clinical aspects of jaundice and nonjaundice

forms of this disease have been studied in general quite closely. Less attention has been paid to pathogenicity and especially its nonjaundice forms. Profound examination of problems of the course of leptospirosis with the aid of antileptospirosal sera is still underway (V. I. Terskikh, K. N. Tokarevich, and Ye. S. Galitskaya), of leptospirosal gamma-globulin (A. A. Varfolomeyeva, Ye. S. Stanislavskiy and A. F. Goncharyuk, A. L. Lesnikov and Ye. M. Popova), and antibiotics (A. A. Abramovich and P. K. Podgorbunskiy, and Ya. S. Pupkvich-Diamant).

Investigations are underway to upgrade laboratory methods of diagnosing leptospirosis (N. N. Tarasevich and V. G. Mitrofanov, A. M. Krupnikova and I. Ye. Trop, L. S. Novikova, Yu. G. Chernukha, etc.).

Soviet scientists have proposed a heated vaccine incorporating L. icterohaemorrhagiae, L. grippotyphosa, and L. pomona (A. A. Varfolomeyeva and G. N. Koval'skiy, 1954) for prevention of epidemic outbreaks of water fever. A test of the efficacy of this vaccine on several tens of thousands of persons has shown that it reduces disease incidence by eight to ten times. V. D. Bukhovets (1950) developed live attenuated divaccine, using nonmunicinate strains L. grippotyphosa and L. pomona for this purpose.

Specific prevention of leptospirosis in farm animals is underway in our country on a broad scale. Of the several vaccine variants, the most widely used is the polyvalent phenolic vaccine of S. Ya Lyubashenko, annually used to inoculate up to five million animals of different species (cattle, hogs, sheep, horses, goats, fur-bearing animals, etc.). Hyperimmune serum giving good results in the early stages of the disease is widely used for preventive purposes on farms unfavorable as to leptospirosis.

Material accumulated by Soviet researchers has enjoyed quite sweeping dissemination both in periodical medical and veterinary publications, as well as in a number of monographs on leptospirosis. Of these, we must cite above all the study by V. V. Aman'in and Ye. V. Karaseva Prirodnaya Ochagovost' Leptospiroz /Natural Focality of Leptospirosis/ (1961), the only monograph in world literature dealing wholly with this problem.

To enlist wide groups of practical workers in solving the problem of leptospirosis and for discussion on urgent theoretical and practical problems, the USSR Ministry of Public Health jointly with leading scientific research institutes has held four all-union conferences on leptospirosis (1946, 1954, 1960, and 1965). The scientific research base on leptospirosis is also being consolidated, represented in 1964-1965 by work done at 48 scientific research and scientific-practical medical and veterinary institutions.

International exchange of scientific information of our scientists on leptospirosis is also becoming wider, and the laboratory on leptospirosis of the Institute of Epidemiology and Microbiology imeni Gabrichevskiy of the USSR Academy of Medical Sciences has begun to fulfill the function of the reference laboratory of the World Health Organization (laboratory head V. V. Anan'in).

Far-ranging plans not only for reducing but also wholly eliminating a number of infections in the Soviet Union compel us not to rest content on what we have reached, but to even further step up efforts in balanced study of leptospirosis, among the most widespread of infections with natural foci lity in the USSR.

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